seed infection by soil organisms during the sensitive period of germination.

On the other hand, experiments with wheat seeds infected with the black-chaff organism have shown that this method used with formalin will completely destroy the organism on the kernels. After screening and fanning to remove shrivelled grains, the treatment should be made by soaking infected seeds for ten minutes in water then draining and keeping moist for six hours. They are then soaked ten minutes in formalin 1:400 solution (1 lb. to 50 gallons of water) drained, and covered for six hours; then dried over-night and planted next day. If copper sulfate is used, the presoaked seeds are thoroughly wetted in the 1:80 solution (1 lb. to 10 gallons of water) for ten minutes, drained and kept moist twenty minutes, plunged for a moment into milk of lime, dried over-night and planted. The effect of the presoaking with water, besides preventing seed injury, is to stimulate dried and dormant bacteria on the seed coat, into vegetative activity, thereby rendering them more sensitive to the action of the disinfectant which must be applied at the end of the presoak period and of course before the seeds have begun to germinate. This is fully in accord with the established principle that microorganisms in a vegetative condition are more susceptible to destructive agents than when dry and in a resting stage.

The effect of the presoak method of seed treatment with chemical disinfectants is, therefore, two-fold—first, seed injury is prevented by the dilution of the disinfectant as it enters the presaturated seed tissues; second, the efficiency of the disinfectant on the pathogen is increased. In view of the fact that nine different varieties of wheat, also oats, barley and maize, have been treated by this method, using both formalin and copper sulfate, disinfectants of widely different chemical nature, in strong solutions (formalin 1:320 and copper sulfate 1:80) without appreciable injury to germination, it appears probable that the same physiological principles here utilized can be applied to other chemical disinfectants and to the treatment of other seed-transmitted diseases amenable to control by these disinfectants, with variations of course in the length of the presoak period (which is six hours for wheat, barley and oats, and ten to eighteen hours for maize) and of the subsequent disinfectant period, as found necessary for each kind of seed and pathogen.

The use of this method in farm practise involves no radical change in present procedure other than to keep seeds moist for definite periods before treatment. If the use of the presoak method is found efficient for the cereal smuts and other diseases as well as for the black-chaff disease of wheat, it will result in a saving of most of the seed now lost by present methods of treatment and also in increased germicidal efficiency. The formulation of this method, as here reported and later to be given in detail, opens up a wide field for the reinvestigation of practical seed treatment for the control of seed-transmitted diseases by chemical disinfectants.

HARRY BRAUN
LABORATORY OF PLANT PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
U. S. DEPT. OF AGRICULTURE

THE AMERICAN PHILOSOPHICAL SOCIETY

THE annual general meeting of the society was held from April 24 to 26 and a program of over fifty papers covering a wide range of subjects was presented. The sessions were presided over by the president, Professor W. B. Scott and by vice-presidents G. E. Hale, H. L. Carson and A. A. Noyes.

Two important features were a symposium on the solar eclipse of June 8, 1918, and one on chemical warfare. In the former special attention was given to photographs and their interpretation of the prominences and the coronal arches and streamers obtained by members of the several expeditions sent from the Lick, the Mount Wilson, the Lowell, the Sproul and the Yerkes observatories.

PROGRAM

Thursday Afternoon, April 24, 2 o'clock

William B. Scott, D.Sc., LL.D., president, in the chair

The cosmic force, radio-action: MONROE B. SNYDER, director of the Philadelphia Observatory.

The conservation of the natural monuments (illustrated): JOHN M. CLARKE, director of depart-

ment of science and State Museum, Albany, New York.

Detection of ocean currents by their alkalinity (illustrated): Alfred G. Mayor, director of department of marine biology, Carnegie Institution of Washington, Princeton, N. J.

Ocean currents moving from warm into cold regions are relatively alkaline and their surface waters absorb CO_2 from the atmosphere so slowly that they remain more alkaline than one would expect from their temperature. Conversely cold currents moving into warmer regions retain their relative acidity and part with their CO_2 at so slow a rate that they become warmer than would be expected from their low alkalinity. In tropical regions of the Pacific the surface currents sometimes observed setting toward the eastward, against the prevailing westerly drift, are relatively acid and contain more CO_2 than we would expect from their temperature. The hydrogen-ion concentration of sea water can so easily be detected by using such indicator as thymolsulphonephthalein that the method may prove of service to navigation in detecting the presence of counter currents before the ship has been deflected from its course.

Some oceanographical results of the Canadian Arctic expedition 1913–18: Vilhjalmur Stefansson, commander of Canadian Arctic Expedition. (Introduced by Mr. Henry G. Bryant.)

Evolution and mystery in the discovery of America: Edwin Swift Balch, of Philadelphia.

Benjamin Franklin's art as applied to books for elementary teaching (illustrated): Charles R. Lanman, professor of Sanskrit, Harvard University.

The energy loss of young women during light household muscular activities (illustrated): Francis G. Benedict, director of Nutrition Laboratory (Boston) of Carnegie Institution of Washington, and Alice Johnson.

To supply exact information regarding the energy requirements for light household work, the Nutrition Laboratory has begun a study of the heat of women engaged in various domestic activities. The subjects thus far studied have been young women from the domestic science department of Simmons College, approximately 200 women taking part in the experiments. The apparatus used for determining the carbon-dioxide production was a large respiration chamber in which 25 or more individuals could be studied simultaneously. The chamber was well ventilated by forcing outdoor air in at one end and withdrawing the chamber air from the other. A certain proportion of the outcoming air was passed through purifiers which absorbed the carbon dioxide. By noting the gain in weight of these absorbers, a measure of the carbon dioxide given off by the young women could be obtained. The heat production or energy loss was then calculated from the carbon-dioxide production. In all, 12 experiments were made, covering 50 periods 20 or 25 minutes in length. To provide a standard for computing the increase in energy required for the particular household occupation studied, the energy loss of the groups of young women while sitting quietly reading two hours after a light breakfast was determined at the beginning of every experiment in from 1 to 3 periods. As a result of 23 rest periods on 12 experimental days, it was found that the average heat output per kilogram per hour was 1.12 calories. This average figure of 1.12 calories has a specific interest in that it indicates the probable heat production of women sitting quietly under ordinary living conditions with a moderate amount of food in the stomach.

The relative contribution of the staple commodities to the national food consumption: Raymond Pearl, professor of biometrics, school of hygiene and public health, Johns Hopkins University.

Hygiene and sanitation as improvised in the zone of operations during the Great War: Bailey K. Ashford, surgeon, U. S. Army. (Introduced by Dr. W. W. Keen.)

Bloodless removal of foreign bodies from the lungs through the mouth by bronchoscopy (illustrated): Chevalier Jackson, attending laryngologist, Jefferson Medical College, Philadelphia. (Introduced by Dr. W. W. Keen.)

Friday, April 25, 10 o'clock

William B. Scott, D.Sc., LL.D., president, in the chair

The new discoveries of extinct animals in the West Indies and their bearing on the geological history of the Antilles (illustrated): William D. Matthew, curator of American Museum of Natural History, New York.

During the last ten years, explorations in Porto Rico and Cuba have secured the fossil remains of various extinct animals from cave and spring deposits on the islands. Quite large collections have been obtained and it has been possible to reconstruct the entire skeleton of the largest animal found, a ground sloth about the size of a black

bear. Four kinds of ground sloths have been obtained in Cuba and one in Porto Rico; all are related to the large extinct North American ground sloth *Megalonyx*. There are also several kinds of rodents, all of them distantly related to South American groups, chinchillas, spiny rats and perhaps agoutis, and a very remarkable little insectivore which is in a family by itself, and is found both in Porto Rico and Cuba. A giant tortoise, very thin-shelled like the tortoises of other oceanic islands but in some respects very peculiar, a terrapin which still lives on the islands and is closely related to species of the southeastern United States, and a crocodile also still living and near to a Central American species, are the principal fossil reptiles. Although the collections are large, no trace of any kinds of hoofed animals or carnivora have been found, nor any other kinds of rodents save the above South American groups, or of edentates except the one family of ground sloths. The characters of the fauna are believed to prove that the islands have been isolated for a long time, at least since the early Pliocene, and have never had any direct connection with North America; and to indicate that they have probably never had any land connection with South or Central America. There is little question that during the Pliocene or Pleistocene the islands were elevated to or near the borders of their submarine shelves, enlarging and connecting them to some extent, and there is some evidence, but not conclusive, for union of the greater Antilles and as far east as the Anguilla bank.

Characters and restoration of the Sauropod genus Camarasaurus Cope, from the type-material in the Cope collection of the American Museum of Natural History: HENRY FAIRFIELD OSBORN, research professor of zoology, Columbia University, and CHARLES C. MOOK.

Energy conception of the cause of evolution: HENRY FAIRFIELD OSBORN.

The parasitic Aculeata, a study in evolution (illustrated): WILLIAM M. WHEELER, professor of economic entomology, Bussey Institution, Harvard University.

Two recent entomological problems—the pink bollworm and the European corn borer: L. O. HOWARD, chief of Bureau of Entomology, U. S. Dept. of Agriculture, Washington.

Hydration and growth: D. T. MACDOUGAL, director of the department of botanical research, Carnegie Institution of Washington, Tucson, Arizona.

Hydration of agar and agar-protein in propionic acid and its amino-compounds: D. T. MACDOUGAL, director of the Desert Laboratory, Tucson, Arizona, and H. A. SPOEHR.

Sterility and self-and-cross-incompatability in shepherd's purse (illustrated): GEORGE H. SHULL, professor of botany and genetics, Princeton University.

Sexual reproduction is a complex succession of processes, all of which must be coordinated with a considerable degree of perfection in order to be successful. The chain of events leading from the spore mother-cells (oogonia, spermatogonia) through successful fertilization to fully developed viable seeds, may be broken at any one of a number of different points, and may be affected by many agents, both environmental and hereditary. No one should expect, therefore, to be able to bring all cases of sterility under a common viewpoint. In the common shepherd's purse (*Bursa Bursa-pastoris*) there exists a great number of biotypes, each of which has its own characteristics with respect to sterility and fertility, as well as other features, both morphological and physiological. In most of the common forms growing in Europe and eastern North America the lower flowers of the main axis are nearly always entirely sterile. A species common throughout the Pacific coast region of North and South America, and extending at least as far eastward as Tucson, Arizona, has, on the other hand, no sterile flowers at the base of the central raceme. A form similar to the Pacific coast form has also been found in Holland. A cross between the Tucson plants and those from eastern America has given rise to partially sterile hybrids which are characterized by rhythmic succession of sterile and fertile flowers, and there is some evidence that this rhythmic arrangement is under the control of two genetic factors, so that the F_2 from such a cross consists of about one like either parent to fourteen which display again a rhythmic succession of sterile and fertile flowers.

The basis of sex inheritance in Sphærocarpos (illustrated): CHARLES E. ALLEN, professor of botany, University of Wisconsin. (Introduced by Professor Bradley M. Davis.)

Hydrogen-ion concentration of nutrient solutions in relation to the growth of seed plants: BENJAMIN M. DUGGAR, research professor of plant physiology, Missouri Botanical Garden, St. Louis. (Introduced by Professor Bradley M. Davis.)

The relation of the diet to pellagra (illustrated):

E. V. MCCOLLUM, professor of bio-chemistry, Johns Hopkins University. (Introduced by Dr. Henry H. Donaldson.)

Friday, April 25, 2 o'clock

George Ellery Hale, Ph.D., Sc.D., LL.D., vice-president, in the chair

The eclipse expedition from the Lick Observatory: some solar eclipse problems (illustrated): W. W. CAMPBELL, director of the Lick Observatory, Mount Hamilton, Calif.

The expedition of the Mount Wilson Observatory to the solar eclipse of June 8, 1918 (illustrated): J. A. ANDERSON, Mount Wilson Solar Observatory, Pasadena, Calif. (Introduced by Professor John A. Miller.)

A description of the equipment used at Green River was given; the compact arrangement of the different units being the chief feature. Owing to clouds, the results were not what was hoped for. Good photographs of the corona were secured; the wave-length of the green coronal line was quite accurately determined; and certain data of value for future eclipse work were obtained.

The Lowell Observatory eclipse observations, June 8, 1918: prominences and coronal arches (illustrated): CARL O. LAMPLAND, Lowell Observatory, Flagstaff, Arizona. (Introduced by Professor Eric Doolittle.)

The author deals with some of the more important results obtained by the expedition sent sent out by his institution, but especial attention is given to the prominences and the detail of the inner corona. Several conspicuous prominences were shown in the photographs and these are generally surrounded by complex coronal structure. These coronal arches or "hoods" are probably among the most conspicuous and remarkable photographed up to the present time. In the present observations there appears to be no doubt as to the intimate relation between the prominences and the surrounding coronal structure. From a comparison of the observations of earlier eclipses made at different epochs of solar activity it seems probable that complex coronal detail and disturbed regions of the corona around and in the neighborhood of the prominences are more pronounced near sun-spot maxima; that such detail is much less conspicuous and occurs more rarely at or near the minima of sun-spot activity.

The flash spectrum (illustrated): SAMUEL ALFRED MITCHELL, director, McCormick Observatory, University of Virginia. (Introduced by Professor John A. Miller.)

Electric photometry of the 1918 eclipse (illustrated): JACOB KUNZ and JOEL STEBBINS, University of Illinois, Urbana, Ill. (Introduced by Professor John A. Miller.)

The Sproul Observatory eclipse expedition: The form of the coronal streamers (illustrated): JOHN A. MILLER, director of the Sproul Observatory, Swarthmore College, Pa.

Results of observations of the eclipse by the expedition from the Yerkes Observatory: EDWIN B. FROST, professor of astrophysics and director of Yerkes Observatory, University of Chicago.

Self-luminous night haze (illustrated): E. E. BARNARD, professor of practical astronomy, University of Chicago.

The author dealt with a little-known feature of the night skies. It is a faintly luminous haze that is sometimes visible on otherwise clear nights when the moon is absent. It does not seem to be connected with any known auroral phenomenon. It seems not to be some form of cirrus or cirro-stratus cloud that for some reason, on rare occasions, is more or less faintly self luminous at night. The source of its light is unknown. When best seen it is quite noticeable as a streaky luminous haze; sometimes it appears in broad sheets. It drifts easterly over the stars and remains visible with a faint steady light for a considerable length of time. Sometimes it seems to be absent for several years. At other times there is a great deal of it. It is seen in all parts of the sky, differing thus from the ordinary auroral phenomena, which are mostly confined to the northern part of the sky.

Photometric measurements of stars: JOEL STEBBINS, professor of astronomy, University of Illinois. (Introduced by Professor Henry Norris Russell.)

Star clusters and their contribution to knowledge of the universe: HARLOW SHAPLEY, Mt. Wilson Solar Observatory, Pasadena, Calif. (Introduced by Professor George E. Hale.)

Tatar material in old Russian: J. DYNELEY PRINCE, professor of Slavonic languages, Columbia University.

Friday Evening, April 25

Reception from eight to eleven o'clock in the hall of the Historical Society of Pennsylvania,

southwest corner of Locust and Thirteenth Streets, at 8.30 o'clock.

Arthur Gordon Webster, Sc.D., LL.D., professor of physics, Clark University, Worcester, spoke on the "Recent applications of physics in warfare" (illustrated).

Saturday, April 26,

EXECUTIVE SESSION—9.30 O'CLOCK

Special business—Action upon the proposed amendments to the laws.

Stated business—Candidates for membership balloted for, with the result that the following new members were declared elected: Robert Grant Aitken, Sc.D., Mount Hamilton, Calif.; Joseph Charles Arthur, Sc.D., Lafayette, Ind.; Edward W. Berry, Baltimore; James Henry Breasted, A.M., Ph.D., Chicago; Ulric Dahlgren, M.S., Princeton; William Curtis Farabee, A.M., Ph.D., Philadelphia; John Huston Finley, LL.D., Albany, N. Y.; Stephen Alfred Forbes, Ph.D., LL.D., Urbana, Ill.; Chevalier Jackson, M.D., Philadelphia; Dayton C. Miller, A.M., D.Sc., Cleveland; George D. Rosengarten, Ph.D., Philadelphia; Albert Sauveur, S.B., Cambridge, Mass.; William Albert Setchell, A.M., Ph.D., Berkeley, Calif.; Julius O. Stieglitz, Ph.D., D.Sc., Chicago; Ambrose Swasey, Sc.D., D.E., Cleveland.

10 O'CLOCK

Hampton L. Carson, M.A., LL.D., vice-president, in the chair

Artificial formations resembling lunar craters: CAPTAIN HERBERT E. IVES, of Philadelphia.

The meteorological service of the Signal Corps in the war: ROBERT A. MILLIKAN, professor of physics, University of Chicago.

Detection of submarines (illustrated): HARVEY CORNELIUS HAYES, Naval Experiment Station, New London. (Introduced by Professor John A. Miller.)

This paper discussed various possible methods. The most effective one resulted from the development of a system of multiple sound sensitive receivers mounted in such a way as to transmit to both ears of the observer a cumulative or summational impulse which becomes a maximum when the instrument is properly directed, thus showing the direction of the submarine. It is clear that such an instrument would be valuable in peace times also in indicating the presence and direction of vessels in a fog.

Errors induced in bullets by defects in their manufacture: ERNEST W. BROWN, professor of mathematics, Yale University.

Sound and flash ranging: AUGUSTUS TROWBRIDGE, professor of physics, Princeton University, and late Lieutenant Colonel Engineers, of General Pershing's staff and in technical charge of the ranging service in the A. E. F.

The work of the Ballistic Institute of Clark University: A. G. WEBSTER, professor of physics, Clark University, Worcester, Mass.

Alternating-current planevector potentiometer measurements at telephonic frequencies (illustrated): A. E. KENNELLY, director, Research Division, Electrical Engineering Department, Massachusetts Institute of Technology, Cambridge, and EDY VELANDER.

The genesis of petroleum as shown by its nitrogen constituents: CHARLES F. MABERY, emeritus professor of chemistry, Case School of Applied Science, Cleveland.

Since so far as known complex nitrogen bases are produced in nature only through the agency of vegetable or animal life the universal presence of these bases in petroleum seems to be convincing evidence as to its origin. In most of the denser varieties these bases have been detected, in California and Russian petroleum in considerable amounts. In the present paper results are presented which show that the same or similar bases are generally present in the lighter varieties of the eastern fields—Pennsylvania, West Virginia and the Berea Grit of southern Ohio. I procured authentic specimens from these fields and find that they all contain from one part in 10,000 to one part in 20,000. A special method of analysis had to be devised to determine such minute proportions of nitrogen, a combination of the Dumas method for nitrogen and the oxygen method for carbon and hydrogen. Briefly described, the combustion was made in a glass tube one half filled with copper oxide, and in the vacant space the oil was placed in a boat with an oxidized copper roll behind and next behind a large boat containing potassium chlorate. In a second furnace was placed a steel tube filled with copper oxide, and heated to full redness to oxidize completely the hydrocarbons. Tight joins were made with castor oil seals and with a special form of rubber tube also luted with castor oil. Nitrogen was sufficiently removed by CO_2 from a rear generator containing several pounds sodium bicarbonate and repeated evacuations with a power pump extending through several days. The paper gives the results of analysis

in a table and in another table the history of the samples.

Graphic representations of functions of the nth degree: Francis E. Nipher, professor emeritus of physics, Washington University, St. Louis.

Glimpses of the near east during the war: A. V. W. Jackson, professor of Indo-Iranian languages, Columbia University.

The empire of Amurru: A. T. Clay, professor of Assyriology and Babylonian literature, Yale University.

The science of stealing (steyacastra) in ancient India: Maurice Bloomfield, professor of Sanskrit, Johns Hopkins University.

The crib of Christ: Paul Haupt, professor of Semitic languages, Johns Hopkins University.

The word translated "manger" in Luke II. 7, denotes one of the arched and open recesses in front of the travelers' chambers along the interior court of a caravansary. Shakespeare uses "crib" in the sense of "small chamber." The inn in which Jesus is said to have been born may be the hostelry mentioned in Jerem. XII. 17 where the Revised Version gives in the margin: the lodging-place of Chimham. The caravansary may have been founded by Chimham, the son of Barzillai, who followed David to Jerusalem (II. Sam. XIX. 38). The name Bethlehem is derived from this ancient inn near the town, on the road from Jerusalem to Hebron. Bethlehem does not mean House of Bread, but House of Bait, *i. e.*, halt for refreshment.

The atonement idea among the ancient Semites: Edward Chiera, instructor in Assyriology, University of Pennsylvania. (Introduced by Professor Morris Jastrow, Jr.)

Saturday, April 26, 2 o'clock

Arthur A. Noyes, Sc.D., LL.D., vice-president, in the chair

Symposium on Chemical Warfare—Historical introduction: Colonel Marston T. Bogert, Chemical Warfare Service, U. S. A.

The speaker gave a brief review of the history of chemical warfare both before and during the war, pointing out the high spots in the field and including also an outline of the organization of the Chemical Warfare Service of the United States Army and its activities.

Chemical warfare and research: Colonel George A. Burrell, Chemical Warfare Service, U. S. A. (Introduced by Colonel Bogert.)

Chemical warfare and manufacturing development: Colonel Frank M. Dorsey, Chemical Warfare Service, U. S. A. (Introduced by Mr. A. A. Blair.)

Production of chemical warfare munitions (illustrated): Colonel William H. Walker, Chemical Warfare Service, U. S. A. (Introduced by Professor H. F. Keller.)

Production of chemical warfare munitions (illustrated): Colonel Bradley Dewey, Chemical Warfare Service, U. S. A. (Introduced by Dr. Philip B. Hawk.)

This paper discussed the following points: (1) The problem of making over 5,600,000 gas masks in eight months; 5,000,000 of these going overseas together with 2,800,000 extra canisters. (2) The history of starting a government-owned factory at Long Island City, which on the day of the armistice covered a million square feet of floor space and had 12,500 employees. (3) The problem of manufacturing the chemicals for gas masks, with mention of the fact that 50 tons a day were necessary and with emphasis of the part played by the peach pit campaign in furnishing some of the 400 tons a day of coconut shells and peach pits necessary to produce the gas mask charcoal. (4) Mention of the manufacture of one half million horse masks and miscellaneous gas defense protective apparatus, other than horse masks. (5) A description with lantern slides showing some of the work done by the Field Testing Section, digging trenches and fighting miniature battles in gas in order to work out the characteristics of gas masks.

The usual banquet on Saturday evening was given at the Bellevue Stratford with about seventy-five members and guests present. Toasts were responded to by Honorable George Gray, Professor E. G. Conklin, Professor J. W. Bright and Dr. J. W. Holland.

Arthur W. Goodspeed

SCIENCE

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